THE DIGITAL PHOTOGRAPHY OF SET INSECT SPECIMENS

M. J. Taylor

Entomology Section, Liverpool Museum, National Museums & Galleries on Merseyside, Willam Brown St, Liverpool, L3 8EN

Abstract

The development of methods for photographing insect specimens using film cameras has already been published (Taylor, 2001).This paper describes methods for use with a Nikon 995 digital camera. A large range of specimen sizes can be photographed within a very compact design. Subjects can be photographed down to a field size of 16 mm by 12 mm. The digital equipment shares the same desirable characteristics as the film version, namely the availability of repeatable and consistent illumination to the specimen including controlled directionality of lighting. True representation of metallic and irridescent colours, pollination patterns, surface sculpture and texture is assured.The portable version of the equipment is light and simply made, breaking down into conveniently transportable modules.The potential for increased accessibility of visual taxonomic data vested in specimens held in museum and personal collections via Web Sites and CDs is discussed.

Introduction

The availability of new models of digital cameras with very close focusing capabilities during 2001 presented an opportunity to develop the equipment designed previously for film cameras for use with these new cameras. The main potential advantage was the elimination of the need to digitise 35 mm slide originals with the associated extra costs and timescales involved, prior to being able to make use of e-mail transfer, construction of reference Web Sites and the production of CDs.

Development of the Portable Equipment

The development of the portable equipment was based upon the simple 45° angled ramp used to develop the original articulated mirror design using natural north light as the experimental light source (Taylor, 2001; Fig. 1).

The original ramp design was impractical for film photography due to its size and weight and the long extension tube lengths required to achieve large magnification images of small insect specimens.The long extension tube lengths resulted in very small equivalent apertures leading to excessively long exposure times which often resulted in reciprocity failure in the film emulsion.

The very close focus capability of the new digital cameras coupled with practical aperture options with high depth of field, and non reliance on film technology removed these obstacles.

Initial experiments with the Nikon 995 camera on the original film experimental outdoor ramp quickly confirmed the potential. A very compact design was developed, weighing 2.5 kg, tailored to this camera. The two element design is based firstly upon a 45° angled ramp with a fixed triple mirror positioned at the lower end. It incorporates a simple insect specimen stage which straddles the fixed mirrors and slides towards and away from the camera to achieve the desired combination of image size and focus. An additional removable piece of 4 mm mirror glass, 25 mm wide by 120 mm long, angled at 45°, is placed across the ramp between the fixed mirrors and the camera front when close focus distances are used which require the

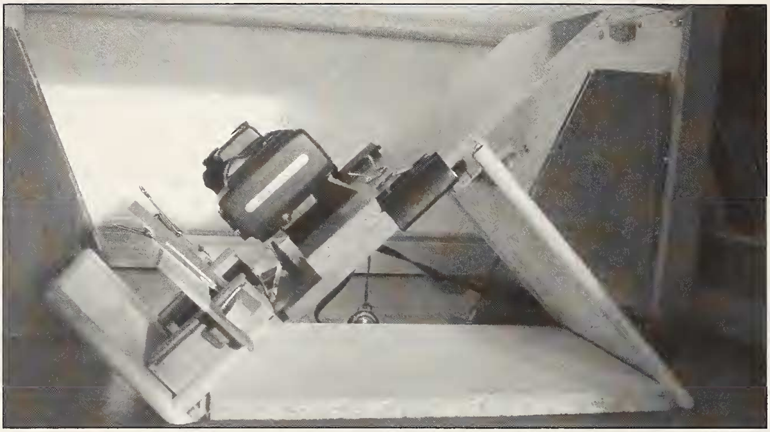

Fig. 1. Portable camera mount and specimen stage.

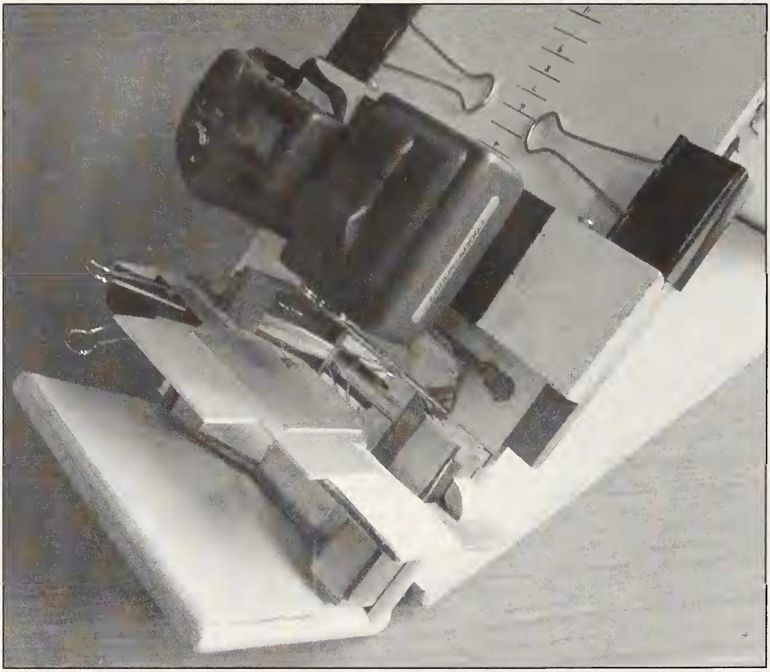

Fig. 2. Close up view of specimen, mirrors and camera.

insect stage to be positioned part way along the fixed mirrors. The specimen stage is held in position by friction by careful fitting during construction. The camera mounting platform, which is made from a simple saddle, straddling the upper part of the ramp also slides up and down the ramp and is clamped in position using large 'bulldog' clips. The ramp assembly is hinged so it can be folded for ease of transport.

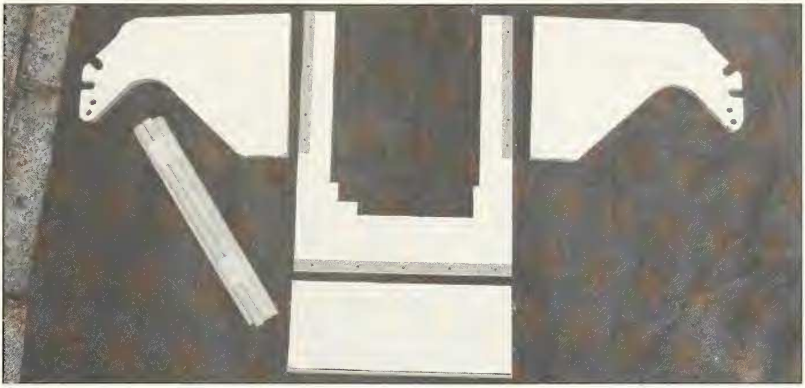

Fig. 3. Screen assembly components.

Fig. 4. Portable equipment in use in Chios, Greece.

Figure 1 shows the hinged ramp with the insect stage and camera in the operating position. Figure 2 shows a close up view of the specimen, mirrors and camera.

The second element of the design is the light diffusing cover. The diffuser is simply made from 15 mm white plastic covered chipboard, cut out using a jigsaw. Holes are drilled in the upper part of the side pieces to locate two 9 mm wooden dowels which provide stability and a fairlead function to separate the two layers of tracing paper forming the removable screens. These two removable screens are located at the top of the assembly in slots provided for the purpose. For overseas use the screen assembly is simply screwed together on arrival and disassembled for transport back home. The screen material used was tracing paper, the screens measuring 260 mm wide with the lower one 320 mm long and the upper one 380 mm long. Both are taped to 15 mm dowels at each end. Figure 3 shows the parts required for the diffuser as prepared for transport overseas. In the case of the prototype, the plastic covering on the Contiboard pieces had been locally removed where they fitted together as the diffuser was to be kept in Chios for use in future years and was to be permanently assembled by screwing and glueing together. Figure 4 shows the complete set of equipment in operation in Chios, Greece.

Development of the Laboratory Equipment

The laboratory version was developed for use in the UK so that the operation could be undertaken independently of weather conditions. The virtually permanent blue skies of the Aegean made the use of the portable version entirely practical in Chios during the survey season from March to November.

The design comprises three elements, the first element is the open fronted work chamber incorporating a light source with a diffuser screen at the top.

The prototype was constructed by converting a small chest of drawers, this was based on a piece of furniture originally measuring 930 mm high, 770 mm wide and 420 mm deep. Such items are regularly available in salerooms for from £20 to £50.

The base of this unit was cut off leaving the upper 580 mm for conversion. In the case of the prototype all the drawers and front lateral struts were removed. A hinged plywood platform was positioned inside the carcase at the top to mount the three 20 W strip lights and a piece of plywood was also attached at the front to screen direct light from the operator and to position the light switch. It was also used to mount a strip of mirror glass internally to reflect light back downwards onto the working area. Figure 5 shows the layout of the strip lights. Alternatively the 'light box' upper section could be made by inverting one of the original drawers and placing it inside the top of the carcase retaining it by means of repositioned drawer bearers. Slots were provided in the sides and the back of the work chamber

Fig. 5. Strip light layout.

Fig. 6. Camera mount and specimen stage.

immediately below the strip lights to hold the light diffuser made from Clear Cracked Ice plastic sheet made by Glaziette Ltd (tel. 0120 479 1185).

A double layer of tracing paper was fixed to the upper surface of this screen to diffuse the light. A piece of black card measuring 90 mm wide by 150 mm long was fixed to the lower surface of the screen to shade the camera monitor screen from direct illumination.

All internal surfaces of the strip light platform and the walls of the work chamber were lined with aluminium kitchen foil and covered with Milk White Cracked Ice textured plastic sheets with the smooth surface against the foil as a light diffusing and reflecting surface. The completed work chamber internal space measures 680 mm wide, 330 mm high and 380 mm in deep.

The second element of the design is the camera mount and specimen stage, it is based on a 45° angled ramp supported by prop and base panels all glued and screwed together. The basic ramp assembly is made from pieces of oak from a plank 170 mm wide and 20 mm thick with a slot 6 mm wide and 7 mm deep running along one edge. The ramp is 400 mm long, the prop 190 mm long and the base 230 mm long, the base being fixed to the bottom ends of the ramp and prop by 20 mm × 20 mm triangular section pieces. The insect stage carriage is positioned at the bottom of the ramp, this is the same item which was developed as the Flash Gun/Stage Carriage for the film version (Taylor, 2001, Fig. 6). In this application only the insect staging facility is utilised. A piece of 4 mm mirror glass 140 mm wide by 255 mm long is fixed to the upper surface of the ramp from the top of the stage carriage to its upper end. The camera saddle, incorporating a knurled screw for engaging the camera tripod thread, is placed at the upper end of the ramp. The saddle is fitted with a metal plate which engages the groove running along the left hand side of the ramp, the saddle is locked into position by a metal dowel fitted through the right hand saddle side engaging one of a number of pre-drilled holes put into the right hand side of the ramp. Figure 6 shows the complete assembly with specimen stage and camera in position.

The third element of the design is the pair of side mirrors which are positioned inside the work chamber against the side walls on each side of the camera ramp.

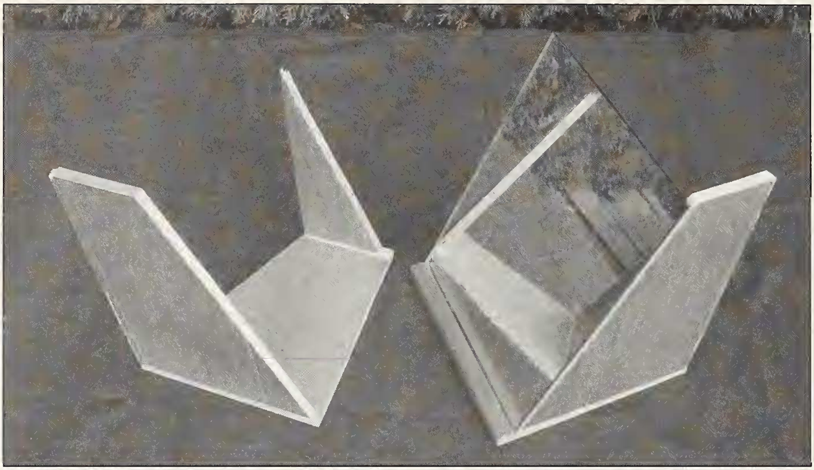

Fig. 7. Construction details of side mirror assemblies.

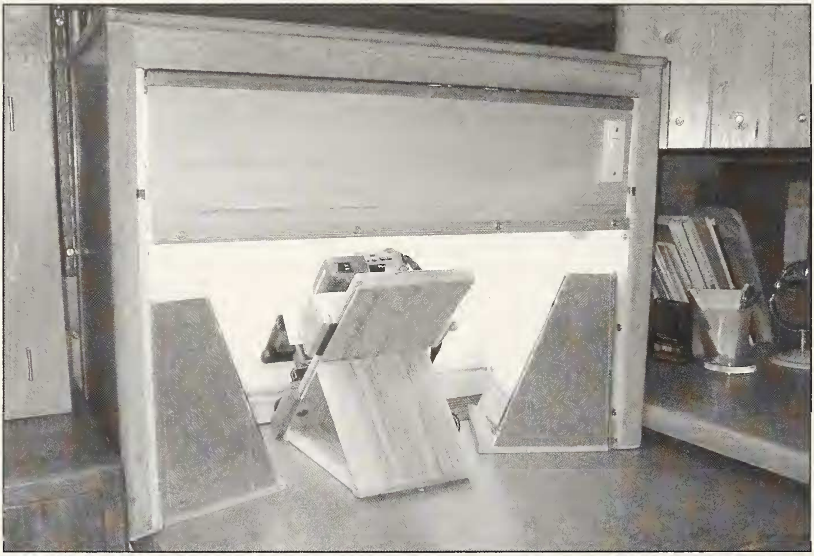

Fig. 8. Laboratory equipment in operation.

These mirrors are positioned to reflect light from the light screen to the lower parts of the specimen. In the prototype system the 4 mm mirror glass pieces originally measured 280 mm high by 200 mm wide. In developing the prototype system, experimentation to optimise the positioning of the mirrors necessitated the trimming of the inner edge to a length of 210 mm due to its intersection with the work chamber side walls. In the optimum position the angle between the bottom edge of the mirrors and the side walls was set at 25°, with the plane of the mirror angled back at 70° to the horizontal. Figure 7 shows construction details of the side mirror assemblies and figure 8 shows the laboratory equipment in operation.

Operation of the Developed Equipment

The portable equipment was used in the summer of 2001 in Chios mainly to photograph the more interesting material as it was removed from the setting boards (see Figure 4). All photography was carried out in the morning between 900 h and 1100 h, almost entirely in sunny clear blue sky conditions with the screens facing direct sunlight. Under these conditions the double layer tracing paper screen reduced the UV levels to such an extent that there was no discernible colour cast when viewing the resultant images on either the 15″ Laptop TFT (thin-film transistor) screen or on inkjet prints. On one or two days when there was a light overcast sky, equally successful results were obtained without the use of the screens.

All specimens, for both portable and laboratory processing, were staged using photographic grey card as the background in the manner described for the use of film cameras, Taylor (2001).

The Nikon 995 digital camera was used in the manual mode. After a little practice the judgement of best focus distance and zoom position was easily achieved, helped by the flexibility offered by the camera optics. When photographing small specimens e.g. one with a span of 12 mm and body length of 9 mm, a focal distance of 0.02 m was selected manually then the specimen was moved towards and away from the camera in the manner described for the type of equipment being used whilst viewing the image on the camera monitor screen. When the optimum position was achieved to give crisp focus, and the zoom control adjusted to fill the frame with the image, the aperture was adjusted manually by stopping down to the minimum achievable aperture under the prevailing light conditions. At very close focus distances the full zoom range of the lens could not be used as there were out of focus zones at the short and long lens focal lengths. This was not a problem as there is a screen display which indicates the achievement or otherwise of correct focus as the zoom control is operated. When photographing very fine details on large insects at minimum focus distances it was sometimes difficult to ensure that focus had been achieved on the exact area required, in these cases a number of exposures were taken with small adjustments to subject to camera distances. The resulting images were then viewed and only the required ones then retained, there being no cost penalty due to wasted film and time.

When photographing larger specimens at longer specimen to camera distances it is best to use the largest working distances and longer focal length optical zoom settings as light levels are somewhat higher and in consequence more stopping down of the aperture is available, also specimen position adjustment is easier to carry out.

When using the laboratory equipment it was not possible to achieve an absolutely neutral colour balance by selecting combinations of light tube colour spectrum and screen materials. However the consistency inherent in the system made colour adjustment simple and routine once the initial digital images had been taken. I prefer to keep my camera 'white balance' at the default settings as the camera is frequently being used for general outdoor purposes, and adjust set specimen image colours using Photoshop colour balance adjustments. In the prototype system I used two standard 20 W tubes and a single north light 20 W tube. I then apply a standard correction of −44 Blue and −20 Red to achieve neutral colour cast. This correction was very easily established due to all specimens having been photographed against a photographic grey card background.

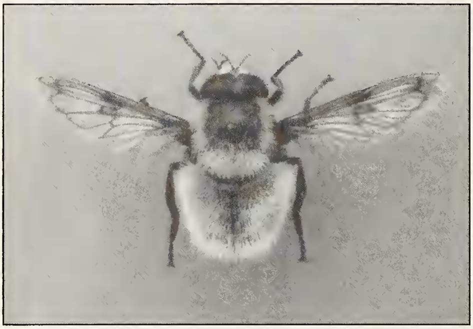

Fig. 9(a). Laboratory photograph of *Volucella bombylans* L. Specimen M0036, I.O.Man.

Fig. 9(b). In field photo of anaesthetised *Tabanus* near *obsolescens* Pand. female, Chios, Greece.

Availability, Selection and Preparation of Set Insect Specimens

The new digital cameras offer huge potential for increased accessibility of visual taxonomic data currently vested in specimens widely distributed in museums and private collections. Reference images freely available via Web Sites and CDs would be of major benefit to students and specialists alike and would encourage wider interest by members of the general public in the subject matter covered.

The vast majority of material in museums is totally inadequate for photographic purposes. Also the use of the small percentage of suitable specimens which are held in museum collections is sometimes withheld for reasons of museum copyright protection. In my survey work on invertebrate biodiversity on Chios I have been building up a reference collection of pristine specimens for photographic purposes, currently particularly strong in some families of Diptera, Coleoptera, Hymenoptera, Lepidoptera and a few other Orders. Digital images from this material are to be made freely available to all for non commercial purposes. Examples of a whole insect and a close up study are shown in Figure 9. Even though I spend a lot of time in the field and on specimen preparation it also takes luck to make progress in obtaining good material. The simplicity, ease and cheapness of producing high quality digital images hopefully will encourage other workers to help build up stocks of suitable specimens and result in increasing numbers of freely available images.

Specialist workers could assist the process by specifying the different general and detailed images most helpful for the study and understanding of their subject matter. This could then ensure the most effective preparation and use of any pristine specimens which become available. The recognition of the location and availability of suitable existing specimens would enable selective collecting activity to be concentrated on securing the most critical missing material.

Computer Manipulation of Digital Images of Set Insect Specimens

One of the most effective uses of high quality digital images concerns the viewing of critical visual characteristics whilst working through identification keys. To take an example of a small robberfly, a specimen of a small species of *Saropogon* measuring 20 mm in span and 12 mm in body length was photographed using the closest focus distance and largest zoom magnification. This resulted in the body length seen on the Laptop 15″ TFT screen measuring 160 mm, this representing the full uncropped frame at a magnification of thirteen times lifesize. The zoom tool can then be used to magnify the image by a further factor of two or three times for critical detail scrutiny. This is all done under restful viewing conditions and convenient adjacency of reference keys, diagrams and textbooks. Images of any particularly interesting features thus revealed can then be saved with a few clicks of a 'mouse', and subsequently sent for assessment to a specialist via an e-mail attachment.

Reference

Taylor, M. J. 2001. The development of a practical technique for achieving realistic photographic images of set insect specimens. *British Journal of Entomology and Natural History*, **14**: 195–206.

SHORT COMMUNICATION

Status of *Paysandisia archon* (Burmeister) (Lepidoptera: Castniidae) in southern Europe.—It was interesting to read that this South American species, recently introduced to Europe was noted in southern England during 2002 (see *Br. J. Ent. Nat. Hist*, **16**: 2003). This insect was introduced into Europe, it is thought in about 1995, by a palm importer at Anglès near Girona in the province of Cataluña, Spain. It is the practice of such importers to bring in mature palms; demand cannot at present be met by growing from seed alone. The preferred foodplants of *P. archon*, *Trithrinax campestris*, the Blue Needle Palm and *Butia yatay*, the Yatay palm, are particularly slow growing in any event. Now, several years later, the insect is well established around Girona and also on the French Mediterranean coast between Toulon and Hyères in the département of the Var (83). It is thought also to have gained a foothold in Italy, though there is no confirmation of this at present. The insect is not just attacking its preferred foodplant, but any palms. Even mature specimens can be killed by infestations. Palms of course have been planted extensively around the Mediterranean coast so it is not short of potential hosts. Spain, too, has an indigenous palm, *Chamaerops humilis*, the Mediterranean Fan Palm, which is attacked.

It was said that the specimen found in southern England was a migrant, but this is unlikely. This insect does not seem to have moved, up to now that is, very far from its point of introduction. Although it has killed every Chusan Palm, *Trachycarpus fortunei*, within a 2 km radius of Girona. The Chusan Palm and many hardy palms are planted and survive quite severe winters well inland, but there have been no other sightings so far other than in the two localities mentioned.

Incidentally, interest in *P. archon* has led to the discovery of another introduction here in southern France, the pyralid *Pseudarenipses insularum* Speidel & Schmitz. The Banana Moth, *Opogona sacchari* Bojer (Tineidae) is also well known by growers. The latter is well established in greenhouses at Sieuras in the département of the Ariège (09) not far from my home.—T. Hollingworth, 6, impasse Frédéric Chopin, F-31700 Blagnac.